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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/680,898	10/08/2003	Zhijun Qu	IR-2378 (2-3	6326
2352	7590	01/25/2005	EXAMINER	
OSTROLENK FABER GERB & SOFFEN 1180 AVENUE OF THE AMERICAS NEW YORK, NY 100368403			MAI, ANH D	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 01/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/680,898

Applicant(s)

QU, ZHIJUN

Examiner

Anh D. Mai

Art Unit

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-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 08 October 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Status Of The Claims***

1. Claims 1-16 are pending.

### ***Specification***

2. The disclosure is objected to because of the following informalities:

A) Paragraph [0017], line 2, states: "...P channel regions 30, 31, 32..." This is incorrect. [0018], line 1-2, correctly states: a gate oxide 40 overlies the invertible channel region between the source regions and respective channel regions...

Therefore, The channel of a power MOSFET should be the areas under the gates 41, between the sources 33, 34, 35 and epi substrate 23.

B) Paragraph [0017], line 4, states: "...below the sources 40, 41 and 42 respectively...".

However, as states in [0018], 40 is a gate oxide, 41 is a gate and 42 is an insulation layer.

Appropriate correction is required.

### ***Claim Objections***

3. Claim 9-16 are objected to because of the following informalities:

Claim 9, in the preamble recites: "...improved..."

The term "improved" does not add any more patentable weight to the instant claims but only shows a personal gratitude.

Appropriate correction is required.

*Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1, line 11, recites: "...away from the  $R_b$ ..."

What is the " $R_b$ " ?

The term has not been properly identified, thus the claims are indefinite.

5. Claims 13-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 13, lines 7-8, recites: a gate structure extending across respective invertible channel regions between said source and channel region at the top of said wafer.

Note that, the channel region is the region under the gate and between the source and the epi wafer.

Lines 8-10 further recites: and a source electrode extending over the top of said wafer and in contact with each of said source and channel regions.

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As shown in Fig. 1, the source electrode 43 have never in contact with the channel regions. It is well known however, the source electrode is in contact with the body regions 30,31,32 and the source regions 33,34,35. (See instant Fig. 1).

Claim 13 is therefore, indefinite.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1- are rejected under 35 U.S.C. 102(e) as being anticipated by Blanchard (U.S. Pub. No. 2003/0122188).

With respect to claim 1, Blanchard teaches a superjunction semiconductor device as claimed including:

a semiconductor body region (1) of a first conductivity type (n) and having parallel top and bottom surfaces;

a plurality of spaced pylons (40/42) of the other conductivity type (p) extending through at least a portion of the thickness of the body region (1);

a respective MOS gated structure (18) including a source region (7/8) disposed in a channel region (5a/6a) which is positioned above and in contact with each of the pylons (40/42),

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the major length of the pylons (40/42) extending from their ends which are closest to the bottom surface being in charge balance with the body region (1) surrounding them;

the remaining length (5b/6b) of each of the pylons (40/42) at the top thereof having a higher concentration ( $p^+$ ) than that of the major length whereby avalanche current is at least partly directed toward the center of the top of the pylon and away from the  $R_b$  region in the channel and beneath the source. (See Fig. 3).

With respect to claim 5, Blanchard teaches a P type semiconductor pylon in an N type body for a superjunction device as claimed including:

the P type pylon (40/42) having an increased concentration at its top end (5b/6b) which is greater ( $p^+$ ) than and overbalances the concentration of the surrounding N type body ( $n^-$ );

the remainder of the length of the pylon (40/42) being in charge balance with the surrounding N type body (1). (See Fig. 3).

With respect to claim 9, Blanchard teaches a superjunction device having improved avalanche capability as claimed including:

a semiconductor wafer body (1) of one conductivity type (n) and having a major electrode (D) on the bottom of the wafer;

a plurality of identical and spaced pylons (40/42) of the other conductivity type (p) extending through at least a portion of the thickness of the wafer (1);

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at least the lower portions (40/42) of the pylons being in charge balance with the wafer body (1); and

a portion (5b/6b) of the top of the pylons having a greater charge ( $p^+$ ) than that of the lower portions ( $p^-$ ). (See Fig. 3).

With respect to claims 2, 5 and 10, the charge in the remaining length of Blanchard seems to be within the claimed range.

With respect to claims 3, 4, 7, 8, 11 and 12, remaining length of the pylons of Blanchard seems to be within the claimed range.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blanchard '188 as applied to claim 9 above, and further in view of Bulucea et al. (U.S. Patent No. 5,701,023).

With respect to claim 13, as best understood by the examiner, the device of Blanchard further includes MOS gated structures (18) disposed at the top of each of pylons (40/42);

the MOS gated structure (18) comprises a channel region of opposite conductivity type (p) and which extends across and overlaps its respective pylon;

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a respective source region (7/8) of the one conductivity (n) extending into each of each channel regions and defining  $R_b$ , regions in the channels and beneath the sources which are removed from the outer periphery of the pylon top;

the gate structure (18) extending across respective invertible channel regions between the source (8) and channel regions at the top of the wafer (1);

and a source electrode (12) extending over the top of the wafer (1) and in contact with each of the source and channel regions. (See Fig. 3).

In Fig. 3, Blanchard just simply shows a source electrode (12) connecting the source (7).

Thus, Blanchard is shown to teach all the features of the claim with the exception of showing the source electrode extending over the top of the wafer and in contact with each of the source and channel regions.

However, Bulucea teaches the MOS gated structure comprises a channel region (65) of opposite conductivity type (p) and which extends across and overlaps its respective body (20);

a respective source region (15) of the one conductivity (n) extending into each of each channel regions (65) and defining  $R_b$ , regions in the channels (65) and beneath the sources (45) which are removed from the outer periphery of the pylon top;

the gate structure (40) extending across respective invertible channel regions (65) between the source (15) and channel regions (65) at the top of the wafer (25);

and a source electrode (45) extending over the top of the wafer (25) and in contact with each of the source (15) and body regions (20). (See Fig. 1).



Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to show the source of Blanchard extending over the top of the wafer and in contact with each of the source and body region as taught by Bulucea to provide signal for the source region.

Note that, errors have been created in the specification that 30, 31 and 32 are channel region, while it is well known in the art that 30, 31 and 32 are the body regions. (See Bulucea's Fig. 1).

With respect to claim 14, the charge in the remaining length of Blanchard seems to be within the claimed range.

With respect to claims 15 and 16, remaining length of the pylons of Blanchard seems to be within the claimed range.

### *Conclusion*

Please note, numerous technical errors have been made in both the specification and the claims. Applicant is advised to review both to correct these errors.

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 6825513

Elhatem

U.S. Patent No. 6,768,170

Zhou

U.S. Pub No. 2004/0224455

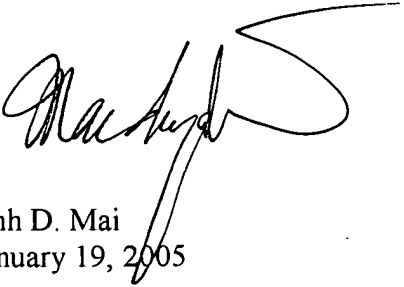
Henson et al.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 9:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Anh D. Mai  
January 19, 2005